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THE RUSTS OF GUATEMALA.*

FRANK D. KERN.

Two botanical excursions have been made to Guatemala, Central America, by Professor W. A. Kellerman; one during the months of January, February and March, 1905, and another during the corresponding season of 1906. The principal object of the trips was to secure collections of parasitic fungi, but a large amount of material which will serve to illustrate the general botanical character of the country was brought back. The trips covered the territory from the Atlantic to the Pacific coast, special attention being given to collecting in the higher altitudes of the intervening mountainous and volcanic regions.

Professor Kellerman has very generously sent much of his material to a number of workers for identification and study, the collections of rusts with some notes having been placed in the hands of the writer. The present communication is a report of the studies upon the larger portion of the material. There still remain a number of specimens, some of which may be undescribed, but concerning which no definite conclusions have yet been reached. In all determinations and in the drawing up of descriptions of new species the writer has been aided by Prof. J. C. Arthur and enjoyed the privilege of access to his herbarium and library.

In many instances new hosts have been added and the geographical distribution has often been extended. It has been found necessary to describe several species as new. Perhaps the most notable single collection is the *Aecidium* on *Byrsonima crassifolia*. The species are distributed among all the larger groups of the Uredinales.

I. COLEOSPORIUM IPOMOEAE (Schw.) Burr. — On *Ipomoea macrocalyx* (Ruiz. & Pav.) Choisy (host no. 5187), Laguna, Depart. Amatitlan, alt. 1200 m., Jan 20, 1906, no. 5408

*Contributions to Guatemalan Mycology IV. (The three previous articles in this series were by W. A. Kellerman.)

(host no. 5191) Jan. 19, 1906, no 5450: *Ipomoea tyrianthina* Lindl. (host no. 5192), Moran, Depart. Amatitlán, alt. 1205 m., Jan 25, 1906, no. 5435; *Pharbitis hederacea* (L.) Roth (host nos. 5185, 5186), Laguna, Depart. Amatitlán, alt. 1200 m., Jan. 17, 1906, nos 5409, 5405.

All of the above hosts were determined by H. D. House.

2. COLEOSPORIUM VERBESINAE Diet. & Holw. — On *Verbesina turbacensis* H. B. K. (host 5190), Los Amates, Depart. Izabal, March 15, 1905, no. 5315; *Verbesina gigantea* Jacq. (host no. 5183), Patalúl, Depart. Sololá, Feb. 13, 1906, no. 5385.

The hosts were examined by J. M. Greenman, who has attached the specific names with some doubt.

3. COLEOSPORIUM ELEPHANTOPODIS (Schw.) Thuem. — On *Elephantopus mollis* H. B. K., (det. by H. A. Gleason), Los Amates, Depart Izabal, alt. 90 m., Mar. 15, 1905, no. 5362.

4. COLEOSPORIUM EUPATORII Arth. — On *Eupatorium collinum* DC., (host no. 5181), Palmar, Depart. Quezaltenango, Feb. 11, 1906, no. 5458.

This host was determined by J. M. Greenman, and is a new one for the species which heretofore has been known only on *Eupatorium macrophyllum* L.

5. COLEOSPORIUM PLUMIERAE Pat. — On *Plumiera rubra* L., (host no. 5218), Palmar, Depart. Quezaltenango, Feb. 11, 1906, no. 5460.

This is the first time this species has been collected on the continent, the other collections coming from the West India Islands. The host has been identified by John Donnell Smith.

6. MELAMPSORA BIGELOWII Thuem. — On *Salix Humboldtiana* Wild. (host det. by R. F. Griggs), near Patalúl, Depart. Sololá, Feb. 16, 1906, no. 5473

7. UROPYXIS MIRABILISSIMA (Peck) Magn. — On *Odostemon* sp., Volcano Agua, Depart. Sacatepéquez, alt. 3000 m., Feb. 15, 1905, no. 4624.

8. RAVENELIA SPINULOSA Diet. & Holw. — On *Cassia biflora* L (host no. 5189), Gualan, Depart. Zacapa, alt. 122 m., Dec. 30, 1905, no. 5441.

This host has been identified by J M. Greenman and is a new one for this species of rust. Sydow (Annal. Myc. 1:330, 1903) and Dietel (Bot. Centr. Beih. 20:394, 1906) have reported

another species of *Ravenelia*, *R. papillifera* Syd. on *Cassia biflora* from Bahama Islands, collected by J. J. and A. R. Northrop, but this material has since been examined by N. L. Britton, of the New York Botanical Garden, who reports that it is *Cassia angustisiliqua* Lam. and not *C. biflora* L.

9. RAVENELELIA HUMPHREYANA P. Henn. — On *Poinciana pulcherrima* L. (*Caesalpinia pulcherrima* Lév.), (host det. by R. F. Griggs), Gualan, Depart. Zacapa, alt. 122 m., Dec. 27, 1906, no. 5427.

A common species in the North American tropics wherever this host occurs. The type of *R. Humphreyana* was said to be on *Cassia* sp., but a careful examination shows that it is undoubtedly *Poinciana pulcherrima*. As pointed out by W. H. Long (Jour. Myc. 12:236 1906), *Ravenelia pulcherrima* Arth. is a synonym of *R. Humphreyana*.

10. KUEHNEOLA ALBIDA (Kuehn) Magn. — On *Rubus poliophyllus* Focke (host no. 4775), Autigua, Depart. Sacatepéquez, Feb. 18, 1905, no. 5363; *Rubus* sp., Guatemala, Depart. Guatemala, Feb. 12, 1905, no. 4625.

No. 5363 shows some variation in the surface of the urediniospores, the markings being much coarser than is typical. The host of this number was determined by John Donnell Smith.

11. PUCCINIOSIRA BRICKELLIAE Diet. & Holw. — On *Brickellia cavanillesii* Gray (host no. 5198), Volcano Cerro Quemado, Depart. Quezaltenango, Feb. 8, 1906, no. 5448.

This species has previously been known only from Mexico. J. M. Greenman, who examined the host, is somewhat doubtful about the specific determination.

12. PUCCINIOSIRA PALLIDULA (Speg.) Lagerh. — On *Triumfetta* sp. (host no. 4584). Guatemala, Depart. Guatemala, alt. 1465 m., Feb. 3, 1905, no. 4608.

13. CRONARTIUM QUERCUUM Miy. — On *Quercus tomentosa* Willd. (host no. 5234), Guatemala, Depart. Guatemala, alt. 1465 m., Feb. 2, 1905, no. 5304.

This host was submitted to John Donnell Smith, who applied the above specific name with an indication that it is not a typical specimen.

14. UROMYCES CELOSIAE Diet. & Holw. — On *Iresine canescens* H. B. K., Guatemala, Depart. Guatemala, alt. 1465 m., Feb. 2, 1905, no. 4344; Laguna, Depart. Amatitlán, alt. 1200 m., Jan. 20, 1906, no. 5395.

Although all previous collections of this species have been on *Celosia*, these specimens on *Iresine* agree so well with the type specimen, and the similarity between the hosts is so great, that they are placed here without hesitation. The hosts have been determined by J. N. Rose and W. A. Kellerman.

15. UROMYCES HELLERIANA Arth. — On *Cayaponia racemosa scaberrima* Cogn. (host no. 5207, det. by John Donnell Smith), Moran, Depart. Amatitlán, alt. 1205 m., Feb. 1906, no. 5436.

16. UROMYCES INDIGOFERAE Diet. & Holw. — On *Indigofera mucronata* Spreng. (host no. 5228, det. by J. M. Greenman), Gualan, Depart. Zacapa, Dec. 28, 1905, no. 5444.

17. PUCCINIA CYNANCHI Lagerh. — On *Philibertia crassifolia* Hemsl. (host no. 4359, det. by John Donnell Smith), Laguna, Depart. Amatitlán, alt. 1200 m., Feb. 11, 1905, no. 4348, Jan. 20, 1906, no. 5437.

This species is morphologically very similar to *Puccinia Gonolobi* Rav., but differs in its habits of growth, spreading evenly over the surface, extending to the young shoots and sometimes forming witches' brooms, while in *P. Gonolobi* the sori are in small groups.

18. PUCCINIA TITHONIAE Diet. & Holw. — On *Tithonia tubaeformis* Cass. (host no. 4374, det. by John Donnell Smith), Guatemala, Depart. Guatemala, alt. 1465 m., Feb. 3, 1905, no. 4328; Laguna, Depart. Amatitlán, alt. 1200 m., Jan 30, 1906, no. 5425.

19. PUCCINIA SENECTIONICOLA Arth. — On *Senecio petasioides* Greenm. (host no. 5200), Volcano Atitlán, Depart. Sololá, Feb. 16, 1906, no. 5442, (host no. 5201), Volcano Cerro Quemado, Depart. Quezaltenango, Feb. 8, 1906, no. 5418, *Senecio Warszewiczii* A.Br. & Bouche (host no. 5206), Volcano Cerro Quemado, Depart. Quezaltenango, Feb. 8, 1906, no. 5445.

The hosts were determined by J. M. Greenman.

20. PUCCINIA ROSEA (Diet. & Holw.) Arth. — On *Ageratum conyzoides* L., (host no. 4386), Mazatenango, Depart. Suchitepéquez, alt. 330 m., Feb. 28, 1905, No. 4346, (without host no.) no. 5373; San Filipe, alt. 615 m., Depart. Retalhuleu, Feb. 4, 1906, no. 5446.

This species is very similar in the uredinial and telial stages to *Puccinia conoclinii* Seym. and has about the same host distribution. It may be distinguished by its larger spores, the thicker walls and more pronounced umbo of the teliospores.

21. PUCCINIA CONOCLINII Seymour. — On *Eupatorium pycnocephalum* Less. (on host no. 4369), det. by B. L. Robinson), Guatemala, Depart. Guatemala, alt. 1465 m., Feb. 1, 1905, no. 5312; *Eupatorium Rafaelense* Coulter (host no. 5197, det. by J. M. Greenman), Volcano Cerro Quemado, Depart. Quezaltenango, Feb. 8, 1906, no. 5449.

22. PUCCINIA SORGHII Schw. — On *Zea Mays* L., Guatemala, Depart. Guatemala, alt. 1465 m., Feb. 3, 1905, no. 5474.

23. PUCCINIA HETEROSPORA B. & C. — On *Sida cordifolia* L., (host det. by John Donnell Smith), Gualán, Depart. Zacapa, alt. 122 m., Jan. 23 and March 12, 1905, no. 4323.

24. PUCCINIA COGNITA Syd. — On *Verbesina fraseri* Hemsl. (host det. by B. L. Robinson), Guatemala, Depart. Guatemala, alt. 1465 m., Feb. 1, 1905, no. 4324; Laguna, Depart. Amatitlán, alt. 1200 m., Jan. 1906, no. 5412.

25. PUCCINIA ESLAVENSIS Diet. & Holw. — On *Panicum leucophaeum* Hl. B. K., Laguna, Depart. Amatitlán, alt. 1200 m., Jan. 31, 1906, no. 5469.

26. PUCCINIA TETRAMERII Seymour. — On *Blechnum Brownei* Juss. (host no. 5214, det. by John Donnell Smith), Laguna, Depart. Amatitlán, Jan. 17, 1906, no. 5400.

27. PUCCINIA PRUNI-SPINOSAE Pers. — On *Amygdalus persica* L., Antigua, Depart. Sacatepéquez, Feb. 15, 1905, no. 5358.

28. PUCCINIA ARECHAVALETAE Speg. — On *Cardiospermum grandifolium* Sw. (host no. 5211, det. by John Donnell Smith), El Rancho, Depart. Jalapa, Jan. 6, 1906, no. 5461.

29. PUCCINIA INFREQUENS Holw. — On *Salvia cinabarina* Mart. & Gal. (host no. 5229, det. by J. M. Greenman), Volcano Atitlán, Depart. Sololá, Feb. 15, 1906, No. 5438.

30. PUCCINIA XIMENESIAE Long. — On *Verbesina* sp. (host no. 5196, det. by J. M. Greenman), Laguna, Depart. Amatitlán, alt. 1200 m., Jan. 20, 1906, no. 5455.

31. PUCCINIA HYPTIDIS (Curt.) Tr. & Earle. — On *Hyptis spicata* Poit., Morán, Depart. Amatitlán, alt. 1205 m., no. 4327, (host no. 5236), no. 5310, (host no. 5235), no. 5311; (host no. 5227), Fiscal, Depart. Guatemala, Jan. 11, 1906, no. 5443.

The hosts of the first three collections were determined by John Donnell Smith, that of the last collection by J. M. Greenman. Only urediniospores could be found on any of the collections of *Hyptis*. Two collections, one on *Hyptis urticoides*, and one on *H. lilacina*, are not included here, as they differ in having urediniospores with more dense and finer markings and several scattered pores. These have not been assigned to any species.

32. PUCCINIA HELIOTROPII Kern & Kellerm. sp. nov.

III. Telia hypophyllous, gregarious, densely crowded in orbicular groups, 1.5-4 mm. across, often confluent, round, small, 0.1-0.2 mm. across, early naked, pulverulent, chestnut-brown, becoming cinereous by germination, ruptured epidermis inconspicuous; teliospores oblong, rounded or obtuse above, usually narrowed below, 14-10 x 30-40 μ , somewhat constricted at septum, wall pale cinnamon-brown, thin, about 1 μ , thicker at apex (2-4 μ), smooth; pedicel colorless, about half length of spore.

On *Heliotropium indicum* L. (host no. 4372), Gualán, Depart. Zacapa, alt. 122 m., Mar. 12, 1905, no. 4326 (type) and Dec. 30, 1905, no. 5422.

Host no. 4372 was determined by John Donnell Smith and the same collection also bears aecia which without doubt belong to an entirely distinct species of rust. This species is of the ordinary leptopuccinia type. It differs from *Puccinia heliotropicola* Speg. by the longer and more oblong spores with a thickened apex.

33. PERIDERMIIUM GRACILE Arth. & Kern.—On *Pinus filifolia* Lindl., Antigua, Depart. Sacatepéquez, Feb. 13, 1905, nos. 4626, 5355, 5324.

One of the above collections (host) was submitted to C. S. Sargent for identification, the others have been determined by comparison. The type of the species was on the same host from Oaxaca, Mexico.

34. AECIDIUM CISSI Wint.—On *Cissus sicyoides* L. (host no. 5223, det. by J. M. Greenman), Gualán, Depart. Zacapa, Dec. 28, 1905, no. 5440; Los Andes, Depart. Izabal, Jan. 17, 1905, no. 5335.

35. AECIDIUM GUATEMALENSIS Kern & Kellerm. sp. nov.

O. Pycnia epiphyllous, gregarious, abundant on discolored spots opposite the aecia, inconspicuous, punctiform, subepidermal, becoming dark brown, globoid, 100-115 μ wide, 80-105 μ high; os-tiolar filaments up to 65 μ long.

I. *Aecia* hypophyllous, gregarious, numerous on indefinite discolored spots, 0.5-1.5 cm. across, especially extending along the veins, short, 0.2-0.3 mm. in diameter; peridium white, margin erect, slightly erose, peridial cells rhomboidal, 15-25 μ long, somewhat overlapping, walls of equal thickness 2-4 μ , inner moderately verrucose, outer smooth, transversely striate; aeciospores globoid. 16-18 x 18-23 μ , wall colorless, thin, about 1 μ , finely and inconspicuously verrucose.

On *Heliotropium indicum* L (host no. 4372), Gualán, Depart. Zacapa, alt. 122 m., Mar. 12, 1905, no. 4326.

The specimens from which this species is described are a part of the same collection from which *Puccinia Heliotropii* sp. nov. is described in this paper. In gross appearance and habit of growth this species differs from *Aecidium Heliotropii* Tr. & Gal. and *Aecidium bifforme* Peck. It may possibly be identical with *Aecidium heliotropidatum* Schw. of which no specimens have been examined. The description, however, indicates a distinct difference in the distribution on the leaf surface and in the manner of development in the groups.

36. *AECIDIUM BYRSONIMAE* Kern & Kellerm. sp. nov.

O. Pycnia amphigenous and caulicolous, preceding or among the aecia, numerous, evenly scattered over the hypertrophied leaves and branches, conspicuous, subcuticular, becoming chestnut-brown, conical, large, 150-200 μ broad, by 75-85 μ high; ostiolar filaments wanting.

I. *Aecia* amphigenous and caulicolous, from an unlimited mycelium causing extensive hypertrophy, numerous, scattered often crowded, cylindrical, long, deep-seated, 0.5-0.7 mm. in diam. by 1-1.5 mm. high; peridium white, margin erose, somewhat recurved, often deeply torn, peridial cells rhomboidal, overlapping 35-50 μ long, outer wall 3-4 μ thick, smooth, inner wall 5-7 μ thick, coarsely verrucose, transversely striate; aeciospores angularly oval or oblong, often truncate at base, and narrowed above, 26-35 x 39-57 μ , wall pale yellow, coarsely verrucose, thick (3-5 μ); much thicker above (5-15 μ).

On *Byrsonima crassifolia* (L.) H. B. K. (host no. 4368), Sierra de las Minas, Depart. Baja Verapaz, alt. 615 m., Mar 10, 1905, no. 4325.

An interesting species because of the hypertrophy it produces. the prominent subcuticular pycnia, and the long and numerous aecia, but especially on account of the very odd spores, which are

exceedingly large, with coarsely marked thick walls, much thickened above. The characters of the pycnia and eacia are so unlike those of autoecious species on *Malpighiaceae* that it is assumed to be heteroecious. The fact that the pycnia are sugcuticular indicates that it does not belong to the *Uromyces-Puccinia* group but to some genus of the *Raveneliatae* or *Uropyxidatae*. Both host and fungus of a specimen in the New York Botanical Garden, collected at Rancho Guerro, Jalisco, Mexico, June 15, 1892, by M. E. Jones, said to be on an *Ericaceous* host, agree perfectly with this Guatemalan specimen. Because of the long bladdery peridia there is a resemblance to *Peridermium*, and the Mexican specimen has been so labelled, but there can now be no doubt that it belongs here.

37. UREDO BIOCELLATA Arth.—On *Pluchea odorata* Cass. (host no. 5202, det. by J. M. Greenman), Amatitlán, Depart. Amatitlán, Jan. 25, 1906, no. 5388.

The sides of the spores in this species are inflated in a very conspicuous manner making them unusually odd. It has been known before only from the type locality, Florida Keys, on *Pluchea purpurascens*.

38. UREDO FICINA Juel.—On *Ficus aurea* Nutt; Guatán, Depart. Zacapa, Jan 1, 1906, no. 5456.

This species differs from the common *Ficus* rust, *Uredo Fici* Cast., in its larger spores and especially in the paraphyses, which are curved, strong and thick-walled as compared with the more erect, slender, thin-walled ones of *U. Fici*. The host of the Guatemalan specimen agrees so well with a specimen from Florida known to be *Ficus aurea*, that it has been called by that name. The fungus on the Florida specimen is also *U. ficina*. The species is chiefly known from South America, where the type was collected.

39. UREDO CABRERIANA Kern & Kellerm. sp. nov.

II. Uredinia chiefly hypophyllous, gregarious in orbicular groups 2-4 mm. across, or scattered singly, roundish, 0.5-1 mm. across, subepidermal, soon naked, chestnut-brown, pulverulent, ruptured epidermis conspicuous; paraphyses intermixed with the spores, spatulate or sometimes capitate, often irregular, 10-23 x 40-80 μ , heads solid, stipes hollow; urediniospores broadly obovate-ellipsoid, 17-27 x 27-34 μ , wall dark chestnut-brown, thick (3-4 μ), thicker above (5-7 μ) coarsely echinulate with blunt conical tubercles 3-4 μ apart, pores 3, rarely 4, equatorial.

On *Buettneria lateralis* Presl. (?) (host no. 5219), Livingston, Depart. Izabal, Jan. 18, 1905, no. 5465.

This host was determined from fragments by John Donnell Smith, who expresses some doubt as to the correctness of the specific name. With the exception of two species of *Aecidium* from South America, described by P. Hennings, this is the only rust reported on a host belonging to this family, *Sterculiaceae*, or any closely related family. No other spore structures being present the species is described as *Uredo*. The thickened apex of the spores, the intermixed paraphyses, and the gross appearance of the sori indicate that its relationship is with the *Raveneliatae*.

The name is to honor Sn. Manuel Estrada Cabrera, President of Guatemala, patron of education and applied science.

40. *UREDIO TRIXITIS* Kern & Kellerm. sp. nov.

II. Uredinia hypophyllous, scattered, small, round, 0.3-0.5 mm. across, soon naked, becoming somewhat pulverulent, dark chestnut brown, ruptured epidermis conspicuous; without peridium or paraphyses; urediniospores broadly ellipsoid, sometimes somewhat narrowed below, $19-24 \times 25-30 \mu$, wall light chestnut-brown, medium thick ($2-3 \mu$), sparsely and rather inconspicuously echinulate, pores distinct, 2, opposite.

On *Trixis frutescens* P. Br. (host no. 5204), San Lucas, Depart. Sololá, Feb. 15, 1906, no. 5432.

This host was determined by J. M. Greenman and belongs to a section of the *Carduaceae* which does not include any other genera known to bear rusts.

THE LEPIOTAS OF SWEDEN.

H. C. BEARDSLEE.

The following notes on the species of *Lepiota* collected in Sweden by Mr. C. G. Lloyd and the writer during the summer of '05 may be of interest in connection with the papers upon this genus which are appearing in the JOURNAL.

The number of species collected was not large, probably partly at least because work was necessarily stopped the first week of September. Doubtless other species might have been found in the same collecting grounds if work had continued a few weeks longer. The species detected were six in number. *L. procera*, *naucina*, *rhacodes*, *cristata*, *metulaespora*, and *amiantina*. Of *Lepiota procera* little need be said. It was found in the same surroundings in which it would have appeared in the United States and agreed with our plant in every detail. There is, however, food for reflection in the fact that this fine species which lends itself so well to description and illustration that it is easily recognized, even by the amateur, has been reported from so many stations and is known to have so wide a distribution.